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Rana taiwaniana Otsu, 1973, a Junior Synonym of *Rana swinhoana* Boulenger, 1903 (Amphibia: Anura: Ranidae)

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Abstract: Examination of the holotype of *Rana taiwaniana* Otsu, 1973 has revealed that it does not differ from *Rana swinhoana* Boulenger, 1903 in any morphological character, confirming its synonymous status with the latter. Allocation of *R. taiwaniana* to the genus *Amolops* by some authors is not justified.

Key words: *Rana taiwaniana*; *Rana swinhoana*; *Amolops taiwanianus*; Taiwan; taxonomy; synonymy

INTRODUCTION

Rana taiwaniana is an enigmatic frog endemic to Taiwan. It was described by Otsu (1973) based on a male (specimen number not shown) from "Shanlin Chiti of Taiwan", 1600 m in altitude on north side of Mt. Ali, (alt. 7600 m in Frost [1985:516] is incorrect). No additional specimen has been reported officially until now (but see below). In 1977, I had a chance to visit the Museum of Yamagata University, where I saw the holotype of *R. taiwaniana*. At a glance I noticed that the species was nothing but *R. swinhoana* Boulenger, 1903 of the *R. narina* complex. Lue and Lai (1990: 75) also noticed close similarities in morphology and habitat of *R. taiwaniana* and *R. swinhoana*, and suggested the former to be a variety of the latter.

Dubois (1992: 321), however, moved *R. taiwaniana* to the subgenus *Amolops* of the genus *Amolops* without any comments. Duellman (1993: 277), in adding and correcting Frost's (1985) checklist of world amphibians, largely adopted Dubois' (1992) taxonomic arrangement, but retained *R. taiwaniana* in *Rana*, obviously by overlooking the corresponding portion of Dubois (1992). In order to correct these erroneous taxonomic treatments, I wrote a brief note in the description of calls of some *Amolops* species (Matsui et al., 1993: 694).

Probably because my note was not on time, Zhao and Adler (1993) listed this species in the fauna of China without relevant comments. Thus, I was forced to repeatedly emphasize the conspecific status of *R. taiwaniana* with *R. swinhoana* in revising the *R. narina* complex from Japan and Taiwan (Matsui, 1994: 397) and in reviewing Zhao and Adler's (1993) book (Matsui and Ota, 1995: 241).

My taxonomic ideas, while accepted by Fei (1999:368), have been ignored by Frost (2004), who mainly followed Dubois' (1992) system and placed *R. taiwaniana* in *Amolops*. Because Frost's (2004) list is now increasingly utilized by the world's herpetologists and is becoming a

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standard taxonomic reference, any small mistakes involved should be corrected as early as possible.

The main reason for the present taxonomic confusion lies in the absence of convincing conclusions on this problem based on actual examination of the holotype of *R. taiwaniana* since Otsu's (1973) paper. Recently, I had a chance again to visit the Museum of Yamagata University and could closely examine the holotype of *R. taiwaniana*. In this short article, I introduce the present state of the type specimen of *R. taiwaniana* and formally synonymize it with *R. swinhoana*.

Materials and Methods

I examined the holotype of *R. taiwaniana* and another specimen identified as the same species by Otsu, both stored at the Museum of Yamagata University. For comparisons, I chose several species of *Rana* and *Amolops*: *R. chalconota* (Schlegel, 1837), *R. erythraea* (Schlegel, 1837), *R. hosii* Boulenger, 1891, *R. livida* (Blyth, 1856), *R. nigrovittata* (Blyth, 1856), *R. swinhoana*, *A. marmoratus* (Blyth, 1855) (type species of *Amolops*), *A. chunganensis* (Pope, 1929), *A. formosus* (Günther, 1876), *A. himalayanus* (Boulenger, 1888), *A. hongkongensis* (Pope and Romer, 1951), *A. larutensis* (Boulenger, 1899), and *A. torrentis* (Smith, 1923). These species include those utilized by Yang (1991) in his revision of the genus *Amolops*. Specimens used are all stored in the Graduate School of Human and Environmental Studies, Kyoto University (KUHE).

In order to obtain morphometric data for *R. taiwaniana*, 20 body measurements were taken mainly following Matsui (1984, 1994): 1) snout–vent length (SVL); 2) head length (HL); 3) snout–tympanum length (S–TL); 4) snout–nostril length (S–NL); 5) nostril-eyelid length (N–EL); 6) nostril–tympanum length (N–TL); 7) snout length (SL); 8) eye length (EL); 9) tympanum–eye length (T–EL); 10) tympanum diameter (TD); 11) head width (HW); 12) internarial distance (IND); 13) interorbital distance (IOD); 14) upper eyelid width (UEW); 15) forelimb length (FLL); 16) lower arm length (LAL); 17) third finger length (3FL); 18) thigh length (THIGH); 19) tibia length (TL); 20) inner metatarsal tubercle length (IMTL). All measurements were made to the nearest 0.1 mm with dial calipers. A stereoscopic binocular microscope was also used where necessary.

Results

Specimens of Rana taiwaniana

As mentioned above, there are two specimens of *R. taiwaniana* in the collection of the Museum of Yamagata University (Fig. 1A, D). The holotype (Fig. 1A–C) is an adult male with vocal sacs, and kept in a jar with a label indicating that it was collected from Shanlin Chiti, Nantou, Taiwan on 30 July 1970. Another specimen, indicated as a "paratype", is also a male and with a label denoting that it was collected on 3 August 1975 from Wuling, Taiwan.

At my previous visit in the October 1977 (see above), these two specimens were kept in glass jars, and the color of the holotype had already completely faded, but the "paratype" retained coloration (Fig. 2). Nearly 27 years later (February 2004), the coloration has almost completely faded in both specimens (Fig. 1A, D). Moreover, the bodies were much softened, indicating severe decalcification. This made accurate measurements very difficult. Furthermore, because each of the two specimens was bound to a glass plate by thin vinyl strings (Fig. 1A, D), some measurements could not be taken.

The holotype, even in this state, well matched the original description (Otsu, 1973). The tips of fingers and toes were dilated into disks having circummarginal grooves, but lacking the dorsal transverse groove (Fig. 1C). There were almost no tangible differences between the holotype and the "paratype" except for slightly larger size in the latter (see measurements shown below).

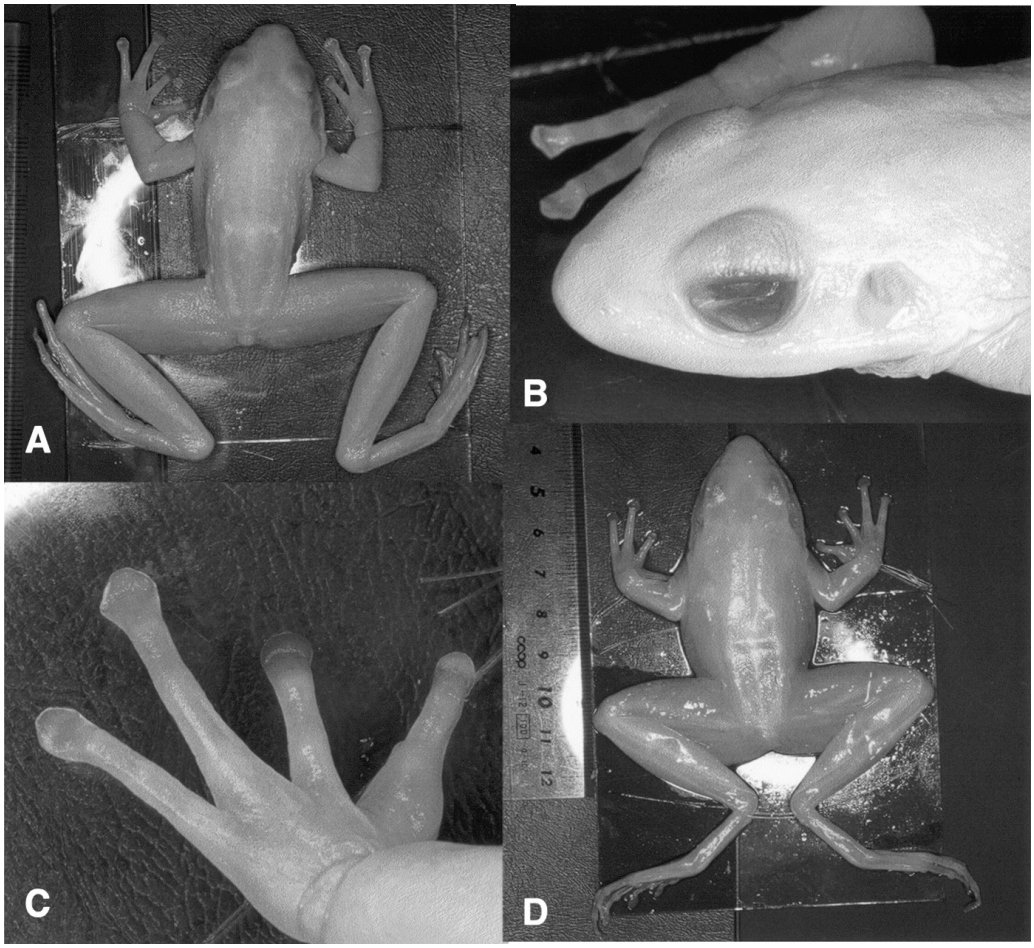

FIG. 1. *Rana taiwaniana*. Dorsal view (A), lateral view (B), and dorsal view of left hand (C) of the holotype, and dorsal view of the "paratype" (D). Photographs taken on 10 February 2004.

Measurements (in mm)

The results of measurements of the holotype were as follows: SVL 67.6; HL 25.1; S–TL 21.2; S–NL 5.9; N–EL 5.3; N–TL 17.2 SL 10.9; EL 9.5; T–EL 3.2; TD 4.2×4.3; HW 24.2; IND 6.1; IOD 6.5; UEW 6.1; FLL 43.5; LAL 33.5; 3FL 12.2; THIGH 42; TL 40.9; IMTL 4.2.

These values slightly differ from corresponding measurements given by Otsu (1973: SVL 65.3; HL 23.5; S–TL 20.1; S–NL 4.8; N–EL 4.8; SL 10.5; EL 9.7; TD 4.0; HW 24.1; IND 6.7; IOD 6.5; FLL 42.0; TL 39.8). It is unknown whether these differences reflect the difference in the method of measurements or slacking of the specimen after a long period of inappropriate preservation.

Another specimen had the following measurements: SVL 73.7; HL 29.1; S–TL 23.8; S–NL 6.1; N–EL 6.8; SL 11.2; EL 9.7; T–EL 2.7; TD 4.2; HW 26.6; IND 7.9; IOD 7.3; UEW 5.8; 3FL 13.1; THIGH 42.3; TL 44.4; IMTL 4.6.

Comparison with other species

In general habitus, and, especially in the shape of the snout (Fig. 1B) and the relative sizes of the disks (Fig. 1C), *R. taiwaniana* was completely different from all members of *Amolops* examined. The head was laterally

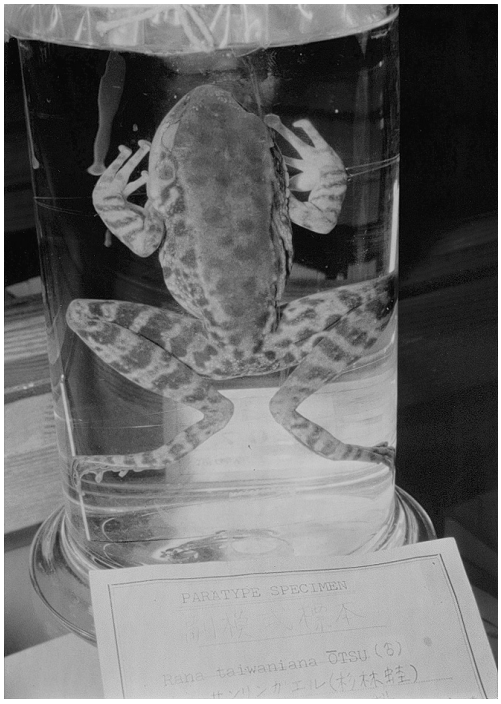

FIG. 2. Dorsal view of the "paratype" of *R. taiwaniana*. Photograph taken on 6 October 1977.

less rounded with less blunt or truncate snout, and the disks in comparison with other phalanges were much narrower in *R. taiwaniana* than in *Amolops*. From the latter, *R. taiwaniana* also differed in lacking the dorsal transverse groove on the disks (Fig. 1C). By contrast, in all these and other characters, *R. taiwaniana* was similar to members of *Rana*, *R. swinhoana* in particular.

The relative sizes of morphometric characters in the holotype of *R. taiwaniana* were simply expressed as ratios to SVL and shown in Table 1 together with those in male specimens of *R. swinhoana* (data from Matsui, 1994). As shown in the table, the holotype of *R. taiwaniana* was slightly out of the variation range of the *R. swinhoana* males examined here in SVL and several ratios.

DISCUSSION

In describing *R. taiwaniana*, Otsu (1973) merely noted its difference from *Rhacophorus*

TABLE 1. Morphological comparison of the holotype of *R. taiwaniana* with male *R. swinhoana*. For the latter, SVL (in mm) was expressed by $\bar{x} \pm SD$ and ratios to SVL by medians (ranges in parentheses). For abbreviations, see text.

	R. taiwaniana (n=1)	*R. swinhoana* (n=10)
SVL	67.6	60.0±4.2 (54.0–67.5)
HL/SVL	37.1	39.0 (37.3–40.0)
S-TL/SVL	31.4	30.9 (30.4–33.1)
S-NL/SVL	8.7	8.1 (7.4–8.8)
N-EL/SVL	7.8	7.6 (7.2–8.7)
N-TL/SVL	25.4	23.8 (22.7–25.2)
SL/SVL	16.1	16.7 (15.7–17.6)
EL/SVL	14.1	14.1 (13.4–15.6)
T-EL/SVL	4.7	3.1 (1.9–3.8)
TD/SVL	6.4	7.3 (6.1–8.5)
HW/SVL	35.8	35.2 (33.4–36.2)
IND/SVL	9.0	11.1 (9.8–12.0)
IOD/SVL	9.6	8.4 (7.2–9.7)
UEW/SVL	9.0	9.4 (9.1–10.6)
FLL/SVL	64.3	67.5 (63.6–70.4)
LAL/SVL	49.6	51.9 (50.4–54.2)
3FL/SVL	18.0	20.3 (18.7–20.8)
THIGH/SVL	62.1	56.9 (54.2–59.0)
TL/SVL	60.5	61.3 (58.8–64.6)
IMTL/SVL	6.2	6.2 (5.6–6.7)

or *Polypedates*, and did not compare the holotype with species of *Rana*, including *R. swinhoana*. He also did not specify the collection number in the original description. However, attached to a reprint Otsu sent me in October 1974 there was a typewritten note indicating that "the type specimen is in the custody of the Museum of Yamagata University, Yamagata, Japan, belonging to Section Zoology: Holotype (Male) i-1, 206; Paratype (Female) i-1, 207. (Japanese name: Sanringaeru)". This specimen number of the holotype was cited in Frost (1985).

Actually, another specimen, indicated as "paratype" on the label attached to it, is stored with the holotype at present in the collection of the Museum of Yamagata University. However, there are some problems regarding this specimen. First, the label also indicates it to be a male, and as shown above it is indeed a male. Second, according to the data on the label, this "paratypic" specimen was collected later (August 1975) than the printed date of publication of the original description (June 1973) or even my receipt of the reprint mentioned above (October 1974). Thus, the data on the label seems to be wrong, but, at any rate, it is surely an additional record of this species. Even so, there is no indication of the presence of a paratype in the original description of *R. taiwaniana*, and, therefore, it is pertinent to consider only the holotype in discussing the taxonomic status of this species.

In placing *R. taiwaniana* in *Amolops*, Dubois (1992) did not give any comment for the change, and Frost (2004) "automatically" adopted this treatment. Dubois (1992) cited Yang (1991) for reference in diagnosing the genus *Amolops*, but this reference shows little about the definition of the genus. Dubois (1992) himself gave only very simple statements that are useless for adults (Ranini in which adults have digital disks and tadpoles have a complete abdominal sucker and dermal glands). He placed *R. taiwaniana* in his subgenus *Amolops*, for which he also cited Yang (1991) for diagnosis and added several characteristics (larval dental formula of 4-8/3; disks without a ventral groove bordering a closed portion; external metatarsal tubercle absent; axillary glands absent). On the other hand, Fei (1999) diagnosed metamorphs of Amolopinae, including *Amolps*, as having enlarged finger and toe tips to form disks on which a transverse groove develops dorsally.

Regarding Dubois' (1992) diagnosis, *R. taiwaniana* certainly possesses digital disks that lack a ventral groove bordering a closed portion, and lacks the external metatarsal tubercle and axillary glands. However, none of these characters distinguish *Amolops* from a part of *Rana*, including those species examined in the present study. Moreover, no tadpoles of *R. taiwaniana* have ever been reported. Thus, Dubois' (1992) placement of *R. taiwaniana* in the genus or subgenus *Amolops* has no basis.

Probably Dubois (1992) surmised from the photographs shown in the original description of *R. taiwaniana* (Otsu, 1973: Figs. 3, 4) that *R. taiwaniana* has a transverse groove on the dorsal surface of disk. However, the holotype of *R. taiwaniana* actually lacks such a groove, and the lines vaguely seen in the photographs are mere shadows formed by inappropriate lighting in taking photographs.

Minor differences in morphometric characters observed between the holotype of *R. taiwaniana* and *R. swinhoana* are most likely due to the bad preservation state of the former. They are regarded as not significant enough to split these two species. Thus, the present report clearly confirms the synonymy of *R. taiwaniana* with *R. swinhoana*, and I hope this is sufficient to terminate the long-lasting taxonomic confusion related to this species. Recognizing the invalid status of *R. taiwaniana* would surely contribute to understand evolutionary history of herpetofauna in both Taiwan and Southeast Asia. Also, it would improve the appendix table of the Wild Life Law of Taiwan, in which *R. taiwaniana* is listed as a vulnerable (category II) species (Peng, 1996: 259).

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